Novel Vascularization of Mouse Heart Tissue-Engineered Vascular Scaffolds by Triggering Decidualization of Mouse Endometrial Stromal Cells for Use in Bio-Synthetic Organs

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Organ transplantation is facing a number of increasingly worrisome problems. Organ shortage threatens an increase in waitlisted patient's mortality. Incompatibility and immunosuppressive compounds also complicate organ transplantation. A solution to this is bio-synthetic organs, which aim to bypass these issues. Currently, vascularization of cell scaffolds is the main issue in the development of synthetic organs.The novel vascularization method being studied is using endometrial stromal cells and triggering decidualization to form endothelial-like cells. This is based on the vast vascularization of the uterus in preparation for implantation of the embryoblast. The purpose of this project is to develop a novel way to vascularize cell scaffolds through endometrial decidualization. If endometrial stromal cells are introduced into a cell scaffold and decidualization is triggered, then vascularization of the cell scaffold will be achieved and can be repopulated with cells of interest. First, a mouse heart was decellularized to obtain a scaffold and endometrial stromal cells (ESCs) were isolated and cultured. Decellularization was analyzed with nuclear stain and compared to control heart. Next, ESCs were decidualized in culture and morphologically analyzed. ESCs were then seeded into the scaffold, stained for analysis, and decidualized. Analysis showed decidualized ESCs within the scaffold, supporting the hypothesis and providing evidence for a proof of concept. This scaffold can be recellularized with cells of interest while also providing deep vascularization for thicker tissue due to the penetration of ESCs far into the tissue. This is important for further development of thicker bio-synthetic tissue and ultimately full organ development.